

Written Testimony Provided By

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To

**The House Commerce, Justice, Science and Related Agencies Appropriations
Subcommittee**

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As the Executive Director of the NASA Aeronautics Support Team (NAST) located in Hampton, Virginia, I appreciate the opportunity to testify before the House Commerce, Justice, Science Appropriations Subcommittee regarding the National Aeronautics and Space Administration's (NASA) Aeronautics research enterprise. I am also currently the Chairman of the Virginia Aerospace Advisory Council.

When I gave testimony to this Subcommittee last year, we were all still awaiting the FY10 budget request from the new Administration – unsure of what to expect, but hopeful that change was indeed on its way for the NASA Aeronautics program. As fate would have it, there were indeed two significant changes from previous years – a new Aeronautics “Green Aviation Initiative” was introduced and a stabilization of the Aeronautics budget that had previously been targeted for cuts year in and year out.

This year's budget request is an even greater improvement – while we have not yet seen the details, it requests an additional \$72.6 million over the FY10 request for NASA's Aeronautics programs and we urge your support for this requested budget. The proposed budget is also of course quiet controversial in other areas, as it proposes a significant shift away from the Space Exploration vision being implemented by the Constellation program. We encourage the Congress to follow the Administration's new path, as difficult as that will be, as we believe it will reinvigorate NASA's traditional role as an innovator. A program dubbed by its own Administrator as “Apollo on steroids” never struck us as being worthy of NASA's heritage of developing cutting edge technology.

The danger to all other NASA programs and budgets from potential massive Constellation overruns has been clearly laid out on several occasions by the Congressional Budget Office – if Constellation is allowed to continue in its present form, CBO has warned that its inevitable cost overruns will likely devastate the budgets for science, aeronautics and earth science in the years to come. Considering the urgent needs of understanding the planet's climate and our effect on it, a massive modernization of the nation's air traffic control system and the growing capabilities to explore the universe with tools such as the James Webb Space Telescope and more sophisticated robotic missions, we believe the new path charted by the Administration is the correct one. The

NAST organization presented such a vision last year to the Congress and the Administration – a white paper titled “The Future of NASA” can be found on our website (www.nastus.org).

We now have reason to hope that there is again a “grand vision and challenge” for NASA Aeronautics in the form of this Green Aviation Initiative. The NASA workforces at the Langley, Glenn, Ames and Dryden Centers have for the past decade been developing incremental improvements to aviation safety, engine fuel consumption and performance, noise control technologies and emissions among other areas. While these activities have been very worthwhile and have helped spur some innovation in design and performance, they have certainly not been “transformative” in any one area or in aggregate. Indeed, NASAs own “performance improvement goals” in areas such as aircraft emissions and engine noise have gone from quiet aggressive to very modest in the past decade.

A radically new next generation subsonic “green” commercial aircraft that may use 75% less fuel and emit a fraction of harmful greenhouse gasses will not look much like the airplanes flying today, and a transformative development effort is desperately needed for several reasons. The US aviation industry faces a potentially huge problem in the not so distant future – the pressure from governments (foreign and domestic) to address the issue of emissions from aircraft engines and their outsized impact on the environment. Aviation currently accounts for about 10 percent of greenhouse gas emissions from transportation in the U.S. Aircraft have complex effects on climate through contrail formation and by emitting water vapor into the dry stratosphere. These high altitude emissions have a far greater global warming impact than if the emissions were released at ground-level. Lest anyone think this is just an academic problem, in December 2007, a coalition of environmental groups, states and regional governments filed petitions with the U.S. Environmental Protection Agency urging the agency to address the effects of vast amounts of global warming pollution from the world's aircraft fleet. The petitions are the first step in a process that requires the EPA to evaluate the current impacts of aircraft emissions, seek public comment and develop rules to reduce aircraft emissions or explain why it will not act.

In order to develop next generation green aircraft technologies to the necessary maturation point for NASA's Aeronautics research program must pivot from working on only “basic” or “fundamental” research to actually designing, building and testing new aircraft concepts. The program in recent years, mainly due to budget cuts, has been restricted to undertaking studies on materials and designs, modeling using computers and wind tunnel testing. Outside of some impressive hypersonic flight demonstrations, there has been a lack of aggressively pushing design limits and flight testing advanced aircraft concepts. These budget cuts required once productive wind tunnels to be shuttered a major flight test aircraft retired to the desert not for lack of research needs, but funding and the will to keep pushing the envelope in technology development.

The emphasis of the entire program must shift back to developing, testing and maturing new aircraft technologies so that they are ready for handoff to industry for development into actual commercial aircraft. The new Boeing 787 Dreamliner is an illustrative example of the level of effort required for major new aircraft technologies – it took NASA and the FAA, working in conjunction with Boeing, almost 10 years and tens of millions of dollars to design, fabricate, test

and certify as safe the new all composite fuselage featured on the Dreamliner. Major leaps ahead in technology are not easily achieved – they require years of steady work to develop technologies to the maturity point where industry can confidently incorporate new discoveries in actual aircraft. NASA, through this new Green Aviations plan, should in coming years re-direct an increasingly large portion of its aeronautics research and development budget to such fabrication and test activities that achieve a higher level of technology readiness for new innovate designs that can radically improve fuel efficiency.

Additional effort and funding is needed in the relevant areas of NASA aeronautics research such as engine design and combustion, contrail formation and mitigation, lightweight structures and materials, alternative fuels and advanced fuselage concepts. NASA should also reinvigorate past research into alternative energy sources for aviation propulsion such as batteries and fuel cells with the goal to demonstrate powered flight. Additional research into the Blended Wing-Body aircraft flight tested in 2007 should occur. Such technologies are forward looking and would be employed on a next generation of commercial aircraft, not existing planes.

In order to eliminate the impact of climate change of depositing water vapor in the stratosphere, new “green” aircraft will be required to operate below about 27,000 feet altitude. This operating restriction could have the effect of significantly reducing ride quality and will require additional new technologies. The major elements of the technology base for these new aircraft are in the traditional areas of aviation research, aerodynamics, structures and materials, propulsion, and avionics and exist currently in NASA’s Subsonic Aircraft Research Program.

A program of research is proposed that will bring the above described technology base up to a technology readiness level (TRL) of at least 6. While the initial investment in the Green Aviation program is appropriate at roughly \$50 million annually, it will need to grow incrementally each year to enable true technology and design demonstration – the eventual annual investment we believe should grow to \$300 million, over the next four years. The program will require the close involvement of key universities and the US aircraft industry. It will expand many current NASA Aeronautics programs and investigations, and allow the research to be done on a larger scale to gain better fidelity to real design challenges for a full scale system. Although a five-year budget is proposed, many of the program elements will require more than five years to reach TRL 6.

This research on developing an actual flying prototype “green” aircraft must also be supported simultaneously with research to accelerate the deployment of a Next Generation Air Traffic Control System. The requirements to provide efficient ground and in-flight aircraft operations to minimize fuel burn combined with the super-density traffic that will result from operations restricted to below 27,000 feet place new requirements on the airspace management system. This will also require development of airborne conflict detection and resolution systems. It is estimated that successful implementation of such a system could reduce fuel burn up to 15% and enable the implementation of operation below 27,000 feet. Specific technologies to be developed include 4-D trajectory based operations, highly automated ground systems, reduced in-flight separation, dynamic resource allocation, and integrated, a diagnostic approach to safety, real-time weather prediction incorporated into 4-D trajectory calculation and updating.

A five-year program of research is proposed that will result in demonstration of the system in a relevant operational environment, enabling the achievement of TRL 6. The NASA NextGen development program should be initially funded at \$50M and grow to \$100M per year in four years. This flight demonstration program would be conducted in collaboration with package delivery fleet operators, and would involve equipping and operating a significant number of aircraft for a year-long demonstration.

Lastly, since the end of the Cold War NASA's aeronautics budget has been on the decline and resources have not been applied to properly maintain and upgrade NASA's test facilities; thus some facilities are a poor state of disrepair and others are nearing obsolescence without technology upgrades. Four years ago NASA initiated the Aeronautics Test Program to start addressing these issues. Although this program has been successful in addressing smaller maintenance issues, the resources available in this program will not sustain the facilities in the long term. Just as the administration is proposing additional funding for upgrades to NASA launch facilities in Florida, we ask that the Subcommittee also consider the needs of the nation's aeronautics test facilities and require that NASA in the future .